Chapter 6: Feasibility Analysis

The purpose of the Feasibility Analysis chapter is to consider the market viability and economic feasibility of the alternative development scenarios explored in Chapter 5 for the two potential transit alignments (B and C), especially in terms of the transit-oriented development (TOD) that a high-capacity transit corridor might spur in the Inner Katy area. The TOD scenarios were created through a public workshop process, followed by further refinement by the consultant team. This chapter provides a "reality check" of the projected growth in population, employment, housing and business activity implied by the conceptual scenarios by considering the ability of the Inner Katy area to "absorb" and accommodate such growth.

The feasibility analysis was conducted in two parts: 1) an assessment of cost factors, such as infrastructure investment, associated with the study area's development and redevelopment potential, and 2) an overview of potential benefits to the City of Houston, such as sales and property tax revenue, employment that might be generated, and how these jobs may enhance the city's overall business mix. A complete cost-benefit analysis was beyond the scope of this study. This type of detailed analysis would occur as part of the federal approval process for any proposed transit project. Instead, the intent of this chapter is to provide a rough indication of the public expenditures required by the Inner Katy development scenarios and the types of benefits that might accrue. The analysis also does not attempt to quantify whether the economic impacts are *generative* (producing new net growth in the study area) or *redistributive* (a shift of benefits and/or costs from one portion of the city to another).

Chapter Highlights

- Estimates of the economic impact of each development scenario were driven by projected growth in square footage, population and employment. Assuming the densities suggested by the scenarios, Alignment B offers the highest economic impact due to the more intensive development pattern it affords.
- While it seems likely that Inner Katy is poised for significant future growth, given demographic and housing trends and Houston's overall expansion, the population and development densities envisioned in the alternative development scenarios are significantly higher than current forecasts for the area would suggest.
- The capacity of the Inner Katy market to attract this type and scale of development will depend on a number of factors, including supply and demand of housing, job growth in downtown versus suburban locations, and the performance of other markets within the IH 610 loop.

<u>Absorption of Population, Housing and Employment</u>

- The growth suggested by the most intensive development scenarios would nearly triple the current number of housing units in the Inner Katy study area (in 2000, there were just under 16,000 housing units in the 10 Census tracts that comprised the area). The number of additional households yielded by the development

scenarios ranges from 12,638 (Alignment C, Scenario 1) to 28,393 (Alignment B, Scenario 2).

- Population could be nearly quadrupled, from approximately 33,600 persons in 2000. Depending on assumptions used regarding persons per household, the housing unit projections would translate into the addition of between 19,715 and 96,252 residents (based on 1.56 versus 3.39 persons per household, which were the highest and lowest household sizes reported in the 2000 Census for the Inner Katy area).
- Job growth would be less dramatic given the area's relatively large employment base (an estimated 18,100 people were employed in the 77007 zip code in 1999). The number of new jobs generated would range from less than 2,500 to nearly 10,000.
- If the Inner Katy area were to add between 986 and 4,813 people annually, as suggested by the development scenarios, it would be absorbing between 1.7 and 8.4 percent of the county's entire population growth each year, which would be a dramatic turn of events relative to current trends.
- When forecasted growth rates from the Houston-Galveston Area Council (H-GAC) were applied to 2000 Census population figures for the area, a population increase of only 1,816 persons (5.4 percent) over 25 years resulted. This is substantially lower than the increase suggested by even the most conservative Inner Katy development scenario (19,715 persons using Alignment C, Scenario 1 and assuming an average of 1.56 persons per household).
- The 632 to 1,420 additional households per year in Inner Katy suggested by the development scenarios would be the equivalent of 3.4 to 7.6 percent of the number of new households projected annually for all of Harris County.
- The densities suggested by the alternative scenarios assume that very little of the new development or redevelopment in the area will be single-family residential. In fact, there has been a considerable amount of single-family development in Inner Katy, and there is no reason to assume that interest in this type of housing product will dissipate.
- While the highest growth rates in both multi-family and single-family construction continue to occur in suburban areas, Inner Katy could benefit from an increasing desire for closer-in, higher-density residential living. Traffic congestion and the availability of high-capacity transit may increase the area's attractiveness and therefore housing demand.
- When forecasts of metropolitan-level employment growth are extended over a 20-year horizon, the annual employment gains suggested in the development scenarios would represent between 0.3 and 1.0 percent of the total area-wide job growth for Houston (122 to 485 additional jobs per year within Inner Katy). As with population, the job projections are much lower when H-GAC's forecasted growth rates are applied to existing employment in Inner Katy (only 1,044 additional jobs, or 5.8 percent growth, by 2025).

Costs: Transit-Related

- A recent General Accounting Office (GAO) study of mass transit projects in selected U.S. cities found a wide range of capital and operating costs for the implementation of light rail transit (LRT) and bus rapid transit (BRT)—and also noted the difficulty of cost comparisons between cities.
- Construction costs for Houston's 7.5-mile "starter" LRT line and the accompanying 16 stations are currently estimated by METRO at $324 million. This translates to an average of $43.2 million per mile, somewhat above the average cited in the GAO study ($34.8 million per mile).
- Based on GAO data, the cost of improvements to facilitate bus rapid transit in the Inner Katy area would range from $1.3 million to $72.0 million, while costs for the construction of exclusive busways range from $51.3 million to $412.5 million.
- Based on Houston's own, new experience with light rail implementation, capital costs for light rail in the study area would range from $298.1 million to $324 million. Earlier METRO figures showed each non-elevated transit station costing $500,000, meaning $3 million total for six stations across Inner Katy.
- Evaluation of potential operating costs in Inner Katy indicated that, for light rail, the one-mile operational cost would range from a low of $28.98 (on Alignment C) to a high of $117.00 (on Alignment B). The low cost for BRT is $12.01 per mile (on Alignment C), and the high cost is $63.90 (on Alignment B).
- While bus rapid transit is substantially less costly to implement than light rail, LRT may be preferable as the long-term transit mode for Inner Katy given doubts about the ridership "attractiveness" of BRT. Furthermore, BRT may have less influence on developer decisions since it is perceived as a less permanent investment, subject to possible relocation of routes and transit stops.

Costs: Supporting Infrastructure

- In addition to transit-related costs, the construction of high-capacity transit in the Inner Katy study area would require significant capital investment to provide the necessary street and utility infrastructure to support the projected influx of new residents and businesses.
- Insufficient information was available to calculate the specific cost of non-transit infrastructure improvements required under each development scenario. However, the intensive development pattern set out in Alignment B, Scenario 2, combined with the lack of an existing street network along portions of the alignment, would suggest higher infrastructure costs.
- Where possible, it makes sense to combine significant transit construction with other planned capital improvements to support an area's development.

Benefits: Sales Tax Revenue

- Increased sales tax revenue would be generated by redevelopment of the Inner Katy area in two ways: 1) by new residents shopping at existing retail establishments, and 2) by new and existing residents shopping at new retail outlets.
- Based on sales tax data for Harris County published by the Texas Comptroller of Public Accounts, the additional retail establishments proposed in the Inner Katy development scenarios would generate between $14.6 million (for Alignment C, Scenario 1) and $35.2 million (under Alignment B, Scenario 2) in new sales tax revenue.
- Using an estimate of $6,693 in taxable retail sales per Harris County resident in 2001, the state and local sales tax revenues that might be generated by the influx of new residents to the area ranged from $10.9 million (for Alignment C, Scenario 1) to $53.1 million (for Alignment B, Scenario 2). Note that these figures and the tax revenue estimates from new establishments cannot be added together as they overlap to some extent.
- The more extensive retail development potential afforded by Alignment B, Scenario 2, suggests higher sales tax revenues.

Benefits: Property Tax Revenue

- Based on the scenario modeling completed for Chapter 5, the greatest quantity of development occurs under Alignment B, Scenario 2, yielding 33.2 million square feet of new space (88 percent residential, 10 percent retail, and two percent office).
- Based on estimated construction costs of the projected future land use, the value of new development was highest along Alignment B, estimated at $1.6 billion (Scenario B-1) to $2.1 billion (Scenario B-2). It was also determined that approximately $800 million of this development would occur within one-quarter mile of transit stations, as would be expected in a TOD scenario.
- Exact estimates of potential property tax revenue could not be calculated due to: 1) the complexity of the property tax system, and 2) a lack of data about specific structures that might be built in the area.

Benefits: Wages and Income

- The greatest amount of new employment is indicated by the Alignment B scenarios, with Scenario B-1 generating approximately 9,700 jobs. Alignment B, Scenario 1 yields the most office-related employment by far (4,159 jobs), while Scenario B-2 ranks highest on retail employment (4,767 jobs).
- The large tracts of industrial land along Alignment B present an opportunity for light industrial or large-scale office development not available along Washington Avenue. Given the higher wages afforded by these types of

jobs, Alignment B, Scenario 1 provides the greatest potential for creating higher-wage jobs.

- Both potential high-capacity transit alignments cross some of the highest- and lowest-income areas within Inner Katy. The emergence of transit-oriented development along either alignment could serve to raise income levels throughout the area.

Benefits: Economic Diversification

- Diversification of the economic base of the Inner Katy area should be a consideration in the decision to invest in high-capacity transit. Transit-oriented development provides the opportunity to create a broader and stronger retail mix in the area, regardless of alignment.
- The additional office and industrial development suggested by Alignment B could provide an opportunity to capitalize on the study area's proximity to downtown and help reverse the trend of professional services and light industry moving away from the central business district. These uses contribute to a healthy economic mix, along with more diverse retail.
- Light rail can help reverse the trend of downtown and central-city areas losing retail sales to suburban development, as evidenced by the experiences of Portland, Dallas and other cities with major transit investments. LRT makes access possible without having to worry about parking, which is typically a major obstacle to greater central-city investment.
- On the other hand, introduction of high-capacity transit may eventually move manufacturing facilities out of the area due to increasing property costs.

Further detail on these and other findings of the Feasibility Analysis are presented in the remainder of this chapter.

Absorption of Population and Housing Units

A key factor in the Feasibility Analysis is whether the Inner Katy area could attract and "absorb" the extent of development—both residential and commercial—suggested by the conceptual scenarios presented in Chapter 5. The proposed population and development densities are significantly higher than current forecasts for the area would suggest. However, based on historical performance and future growth patterns in Harris County, it seems likely that Inner Katy will experience substantial growth. This growth will be driven by the continued expansion of the Houston metropolitan area, as well as by other demographic trends, such as the movement back to more urban environments. The effect of achieving or not achieving the density outlined in the development scenarios will have large ripple effects on the ultimate impact of investments in high-capacity transit (HCT) in the area.

The quantities of new households and employment that were calculated in Chapter 5 for each alternative development scenario are repeated in **Table 6.1**.

To arrive at an estimate of the increased population that might accompany the additional residential development suggested in Table 6.1, the number of new households in each of the four development scenarios was multiplied by various household sizes (based on 2000 Census data on persons per household for the 10 Census tracts that approximate the Inner Katy study area and for Harris County as a whole). The results of these calculations are presented in **Table 6.10** in the Appendix to this chapter. Next, potential annual growth in households, population and employment was estimated over 20-, 30- and 40-year time periods. These results are displayed in **Table 6.11**, also in the Appendix.

TABLE 6.1:
New Households and Employment from Development Scenarios

	Potential New Development		
	Scenario	Households	Employment
Alignment B	1	18,307	9,703
	2	28,393	6,087
Alignment C	1	12,638	2,435
	2	20,224	4,450

Source: Fregonese Calthorpe Associates

The number of additional households yielded by the development scenarios ranges from 12,638 (Alignment C, Scenario 1) to 28,393 (Alignment B, Scenario 2). Depending on the persons per household assumptions used, this would result in the addition of between 19,715 and 96,252 residents (based on 1.56 versus 3.39 persons per household, which were the highest and lowest household sizes reported in the 2000 Census for the Inner Katy area). The number of new jobs generated would range from less than 2,500 to nearly 10,000. Assuming a development horizon of 20 years, this would mean the addition of between 632 and 1,420 housing units and between 986 and 4,813 people annually. Job growth over the same period would range from 122 to 485 new jobs per year.

The growth suggested by the most intensive development scenarios would nearly triple the current number of housing units in the Inner Katy study area (in 2000, there were just under 16,000 housing units in the 10 Census tracts that comprised the area). Population would be nearly quadrupled, from approximately 33,600 persons in 2000. Job growth would be less dramatic given the area's relatively large employment base (an estimated 18,100 people were employed in the 77007 zip code in 1999).

To determine if this level of growth would be possible within the study area, historical trends and future projections for population, housing and employment are explored in the following sections.

Population

The Houston primary metropolitan statistical area (PMSA, which includes Chambers, Fort Bend, Harris, Liberty, Montgomery and Waller Counties) added approximately 856,000 people between 1990 and 2000, an increase of 25.8 percent. The largest growth, in terms of the number of people, was seen in Harris County, which added nearly 600,000 persons. However, the greatest percentage increases were seen in the suburban counties of Montgomery (61.2 percent) and Fort Bend (57.2 percent). Complete Census figures are displayed in **Table 6.12** in the Appendix to this chapter.

As discussed in Chapter 2-Existing Conditions, Census data for the Inner Katy study area indicated little net growth between 1990 and 2000 (actually showing a slight population loss of 305 persons) despite significant development activity later in the decade. Among the 10 tracts encompassing the area, half had population gains and the other half population losses. One tract, Tract 5102 (bounded by S. Heights Boulevard to the west, Sabine Street to the east, IH 10 to the north, and Buffalo Bayou to the south), experienced a 25 percent increase by adding 536 persons.

According to the Texas State Data Center's mid-level growth scenario for Texas, the six-county Houston PMSA is projected to add 1.58 million people between 2000 and 2020 (see **Table 6.13** in the Appendix to this chapter). As in the 1990s, the highest growth in percentage terms is anticipated in suburban counties, such as Montgomery (62.8 percent), Fort Bend (57.3 percent) and Waller (56.7 percent). The largest growth in numeric terms is expected in Harris County, with 1.41 million new residents projected over the 20-year period, an increase of roughly 57,000 people per year. If the Inner Katy study area were to add between 986 and 4,813 people annually, as estimated in the previous section, it would be absorbing between 1.7 and 8.4 percent of the county's entire population growth each year, which would be a dramatic turn of events.

Small-area forecasts for 1990 to 2025 were also used to to evaluate the growth numbers generated by the Inner Katy development scenarios. These forecasts were prepared by the Houston-Galveston Area Council (H-GAC) in 1995 and updated in 1999 (see **Table 6.14** in the Appendix to this chapter). When H-GAC's forecasted growth rates were applied to 2000 Census population figures for the area, a population increase of only 1,816 persons (5.4 percent) over 25 years resulted, as shown in **Table 6.2**. This is substantially lower than the increase suggested by even the most conservative Inner Katy development scenario (19,715 persons using Alignment C, Scenario 1 and assuming an average of 1.56 persons per household).

TABLE 6.2:
Population Forecasts for Inner Katy based on H-GAC Small-Area Forecast

Year	Population	Growth Rate from H-GAC Small-Area Forecast *(Table 6.14)*
2000	33,620	0.4%
2005	33,754	2.3%
2010	34,531	0.9%
2015	34,842	0.7%
2020	35,086	1.0%
2025	35,436	
Change 2000 to 2025	**1,816**	**5.4%**

Source: 2000 population from U.S. Census Bureau.
Other years calculated by TIP Development Strategies.

Housing

The Inner Katy area's ability to absorb population is closely tied to its development potential. According to the 2000 Census, there were 15,986 housing units in the 10 tracts that approximate the study area (see **Table 6.15**). This represents an increase of 484 units from the 1990 Census, which averages to the addition of roughly 48 housing units per year throughout the decade (net of any demolished units). However, most of this construction likely occurred in the latter part of the 1990s given recent development activity.

Regional projections of households produced by H-GAC are shown in **Table 6.16**. Like population, the largest numeric gains in households are expected in Harris County while the largest percentage increases are forecast for the suburban counties of Montgomery (81.7 percent), Fort Bend (76.6 percent) and Waller (68.9 percent). Over a 20-year period, the forecasted growth for Harris County would translate to approximately 18,750 additional households per year. Therefore, the 632 to 1,420 new households per year in Inner Katy suggested by the development scenarios (see Table 6.11) would be the equivalent of 3.4 percent to 7.6 percent of the number of households projected for the county as a whole.

H-GAC data for the approximate area of Inner Katy predicts the addition of less than 4,000 households during the 25-year period from 2000 to 2025. Also, the number of households is projected to grow at a faster rate than the population (see **Table 6.17** for household growth compared to Table 6.14 for population growth). This suggests that smaller household sizes are expected relative to the average persons per household currently seen in the area.

A more focused household projection for Inner Katy was calculated by applying H-GAC's forecasted growth rates (from Table 6.17) to the number of housing units (the equivalent of households) reported in the 10 tracts during the 2000 Census. This yields an even more conservative outcome, with approximately 2,500 households added to the study area by 2025, an increase of only 16 percent as shown in **Table 6.3**.

TABLE 6.3:
Household Forecasts for Inner Katy based on H-GAC Small-Area Forecast

Year	Households	Growth Rate from H-GAC Small-Area Forecast *(Table 6.17)*
2000	15,986	5.3%
2005	16,833	1.6%
2010	17,103	3.8%
2015	17,752	2.2%
2020	18,143	2.1%
2025	18,524	
Change 2000 to 2025	**2,538**	**15.9%**

Source: Number of housing units in 2000 from U.S. Census Bureau.
Other years calculated by TIP Development Strategies.

However, the H-GAC forecasts, originally prepared in 1995, may not be reflective of the recent surge of residential construction activity in the Inner Katy area and across the entire Houston metropolitan area. The Houston area has experienced strong growth in multi-family housing in recent years, with more than 10,000 units absorbed each year from 1999 to 2001, reaching a high of 13,407 units in 2000. Although historical data for submarkets were not available, CB Richard Ellis reported that the Southwest and Northwest submarkets were the strongest, with each absorbing more than 3,000 units in 2001. Together, these markets, which include the Inner Katy study area, accounted for more than 60 percent of the units absorbed citywide.

NOTE:
The Inner Katy study area is included in CB Richard Ellis's Central market.

TABLE 6.4:
Multi-Family Residential Absorption in Houston: 1990 to 2001

Year	Number of Units Absorbed	Year	Number of Units Absorbed
1990	7,083	1996	6,794
1991	2,081	1997	6,564
1992	3,545	1998	8,313
1993	3,051	1999	10,095
1994	6,479	2000	13,407
1995	7,438	2001	10,373

Source: CB Richard Ellis

If Houston could sustain this level of residential absorption—approximately 10,000 units annually—the proposed Inner Katy development scenarios (adding 632 to 1,420 units per year over 20 years) would require the study area to account for 6.3 to 14.2 percent of the city's entire absorption. It is not clear, however, that construction can continue at this pace. A recent *Houston Business Journal* article (October 26, 2001) reported that 6,000 to 8,000 units per year would represent a more reasonable rate for multi-family construction. Noted University of Houston economist Dr. Barton Smith has also cautioned area builders against overbuilding, especially given continued economic sluggishness in Houston, statewide and nationally.

This recent development along Washington Avenue includes a mix of pre-existing architecture and new residential construction.

The densities suggested by the alternative development scenarios in Chapter 5 also assume that very little of the new development or redevelopment in the area will be single-family residential. In fact, there has been a considerable amount of single-family development in Inner Katy. As mentioned in Chapter 4-Baseline Opportunities Analysis, one-half of all permits filed in the study area in 2001 were for single-family construction or rehabilitation. There is no reason to assume that interest in this type of product will dissipate.

Furthermore, the highest growth rates in both multi-family and single-family construction continue to occur in suburban areas. This would suggest that the Inner Katy area could not absorb the kinds of increases envisioned under the highest-density scenarios. However, the introduction of a new product—close-in, higher-density residential—may alter current patterns. In addition, traffic congestion and the availability of high-capacity transit may increase the area's attractiveness and therefore housing demand.

Employment

Estimates of employment generated by the various development scenarios vary widely depending upon the amount of retail and commercial activity included in a scenario. The highest employment is associated with development along Alignment B (see **Table 6.18** in the Appendix to this chapter).

According to Economy.com, the Houston metropolitan area is forecast to add more than 238,000 jobs between 2002 and 2006, or approximately 47,700 jobs per year. If this estimate is extended over a 20-year horizon, the annual employment gains suggested in the alternative development scenarios would represent between 0.3 percent and 1.0 percent of the total gains across the metropolitan area (122 to 485 additional jobs per year within Inner Katy).

Regional employment forecasts developed by H-GAC for 1990 through 2025 for the eight-county consolidated metropolitan statistical area (CMSA) are more conservative. H-GAC projects an increase of approximately 41,200 jobs per year through 2025, an annual average increase of 1.8 percent. However, because of the magnitude of the metropolitan-level numbers, the percentage share of employment gains that would occur annually within Inner Katy under the various development scenarios (0.3 and 1.1 percent, respectively) is very similar to what was projected for Inner Katy from the more aggressive regional employment forecast.

The H-GAC small-area employment forecast for the approximate Inner Katy area is presented in **Table 6.J** in the Appendix to this chapter. According to H-GAC's analysis, this area is expected to add approximately 4,200 jobs between 2000 and 2020, or roughly 210 jobs per year. To obtain a more focused projection of the number of jobs that might be generated within Inner Katy, the H-GAC growth rates were applied to 1999 employment figures for the 77007 zip code, which roughly approximates the study area as discussed in Chapter 4. Using this more targeted approach, employment in the Inner Katy area is projected to increase by just 5.8 percent by 2025, representing an additional 1,044 jobs as shown in **Table 6.5**.

TABLE 6.5:
Employment Forecasts for Inner Katy based on H-GAC Small-Area Forecast

Year	Employment	Growth Rate from H-GAC Small Area Forecast *(Table 6.19)*
1999	18,146	0.9%
2005	18,309	1.6%
2010	18,598	1.4%
2015	18,852	1.0%
2020	19,037	0.8%
2025	19,190	
Change 1999 to 2025	**1,044**	**5.8%**

Source: 1999 employment from Zip Code Business Patterns for zip code 77007.
Other years calculated by TIP Development Strategies.

Absorption Summary

It is difficult to predict future growth patterns in the study area. However, based on historical performance and projections for Harris County, it seems likely that Inner Katy will experience substantial growth. This growth will be driven by the continued expansion of the Houston metropolitan area, as well as other demographic trends, like the movement back to urban environments. This trend has been well documented in studies such as the May 2001 report issued by Fannie Mae with the Brookings Institute entitled *Downtown Rebound*, which uses Census 2000 data to document population increases in downtowns across the nation. According to the report, Houston had the highest percentage increase in downtown residents of any city in the sample, with an increase of 69 percent between 1990 and 2000.

It is not clear, however, whether the study area will reach the dramatic growth levels suggested by the alternative development scenario modeling in Chapter 5. The capacity of the Inner Katy market to attract this type and scale of development will depend on a number of factors, including supply and demand of housing, job growth in downtown versus suburban locations, and the performance of other markets within the IH 610 loop.

Cost Factors

Two categories of costs were considered in the Feasibility Analysis: 1) transit-related costs; and, 2) infrastructure costs, such as water, sewer, and roads. Transit costs are contingent upon the mode of travel selected and the final alignment, both of which were explored for

the Inner Katy area through this study. The data in this section provide an indication of the general magnitude of costs associated with bus rapid transit (BRT) and light rail transit (LRT), the two primary types of high-capacity transit that were considered for the Inner Katy corridor.

Transit-Related Costs

Costs associated with both the construction and operation of high-capacity transit vary considerably. A General Accounting Office (GAO) report in September 2001 compared capital and operating costs for BRT and LRT systems (*Mass Transit: Bus Rapid Transit Shows Promise*, GAO-01-984). *Capital costs* typically include the costs to plan, design and construct a project. *Operating costs* include salaries, fuel or energy costs, vehicle maintenance, and maintenance of the roadway or, in the case of light rail, the track system. The GAO analysis was based on interviews with Federal Transit Administration officials, industry experts, and transit agency personnel in cities where BRT or LRT systems were used "extensively." The GAO study also noted that cost comparisons between cities are difficult due to differences in the manner in which individual agencies accounted for costs.

The capital costs identified in the GAO study are summarized in **Table 6.6** (operating costs are presented in **Table 6.20** in the Appendix to this chapter). For light rail, capital costs included "stations, structures, signal systems, power systems, utility relocation, rights-of-way, maintenance facilities, transit vehicles, and project oversight." The GAO reported on three types of BRT systems: 1) exclusive *busways* in which separate roads are constructed for buses, 2) buses operating in high-occupancy vehicle (HOV) lanes, and 3) BRT improvements made to existing arterial streets. Capital costs identified for BRT included "signal prioritization, improved stations, and real-time information systems to inform riders of bus arrival times," as well as the more extensive construction required by exclusive busways.

TABLE 6.6:
Capital Cost per Mile from GAO Study
(in millions of dollars)

	Light Rail *(based on 18 lines operating in 13 cities)*	Bus Rapid Transit (BRT)	
		Improvements to Existing Arterials *(3 lines in 2 cities)*	Busways *(9 lines in 4 cities)*
Low	$12.39	$0.19	$7.43
Average	$34.79	$0.68	$13.49
High	$118.83	$9.60	$55.00

Source: General Accounting Office, *Mass Transit: Bus Rapid Transit Shows Promise,* GAO-01-984, September 2001. All costs were escalated to Year 2000 dollars.

The GAO figures are somewhat higher than those used by METRO in its planning process. The following cost assumptions for light rail were developed by consultants in connection with Houston's "Downtown to Dome" starter line:

Costs per Mile (two tracks, including utility relocation and system costs)

- Paved street: $10.5 million
- Ballasted (gravel-based paving) street: $6.0 million
- Aerial (elevated) section: $25.0 million

Station Costs (240-foot length with minimal amenities)

- 500,000 per station for low platform
- $5.0 million for elevated platform

Other Costs

- $3.25 million per vehicle
- $15.0 million for rail maintenance facility construction
- $15.0 million for parking lot construction (15 acres for 1,000 cars)
- $13.0 million for parking garage construction
- 8 percent allocated for right-of-way costs
- 1.75 percent contingency factor

At the time of this study, construction had already begun on the Houston starter line, providing even more refined cost information. Construction costs for the 7.5-mile LRT line and the accompanying 16 stations are currently estimated by METRO at $324 million. This translates to an average of $43.2 million per mile, somewhat above the average cited in the GAO study ($34.8 million per mile).

The GAO figures are higher than those reported in some other studies. A report by the City of Arlington presented capital costs for four light rail lines in three cities: Sacramento, Dallas and San Diego. These costs included construction, right-of-way and vehicle costs and ranged from a low of $4.5 million per mile (San Diego's 30.6-mile starter line) to a high of $15.9 million (Dallas's DART line, which is listed in the METRO report as 40 miles in length). Costs in the City of Arlington comparison were given in 1999 dollars.

Infrastructure Costs

In addition to transit-related costs, the construction of high-capacity transit in the Inner Katy study area would require significant capital investment to provide the necessary infrastructure to support the projected influx of new residents and businesses. In some parts of the study area, such as the former rail corridor segments associated with Alignment B, the introduction of either light rail or bus rapid transit would require the construction of streets and accompanying utilities.

Even in areas with existing infrastructure, such as most portions of Alignment A, light rail transit typically necessitates the complete reconstruction of streets.

Where possible then, it makes sense to combine transit construction with other planned capital improvements. According to information obtained from the office of District H City Council Member Gabriel Vasquez, a total of $28.2 million in capital improvements is currently planned for the study area (see **Table 6.21** in the Appendix to this chapter). A portion of this sum will be used for the reconstruction of Yale from IH 10 to IH 610, and part of Alignment B runs along Yale. However, this improvement is scheduled to be completed in fiscal year 2004, well in advance of any construction of high-capacity transit in the area.

There was insufficient information to calculate the cost of non-transit infrastructure improvements required under each development scenario. However, the intensive development pattern set out in Alignment B, Scenario 2, combined with the lack of an existing street network along portions of the alignment, would suggest higher infrastructure costs.

This example of typical redevelopment within Inner Katy illustrates how higher density, larger structures and more vehicles can begin to overwhelm older, narrow streets and open-ditch drainage that was originally built for a much different type of neighborhood.

The following infrastructure cost assumptions were developed by the City of Houston Planning and Development Department as part of the *Southern Houston Sector Study* conducted in 2000:

- $100 per foot for 12-inch water line
- $150 per foot for 12-inch sanitary sewer line
- $700 per foot for 4-lane major thoroughfare ($3,696,000 per mile)
- $2.8753 average capacity cost per gallon for wastewater treatment
  - residential consumption = 1 service unit
  - 1 service unit = 315 gallons per day
  - 100-unit apartments = 0.71 service units per apartment unit
  - 50,000 square feet of retail = 0.0002 service units
  - 200,000 square feet of office = 0.0003 service units

Cost Summary

The cost assumptions and information outlined above can be used to calculate rough estimates of the costs that might be encountered with either alignment or mode choice. They are intended only to provide an order-of-magnitude estimate of the potential cost. Obviously, the specific design of the line can dramatically affect costs. For example, splitting light rail between two streets, such as the Washington/Center couplet concept, adds approximately 40 percent over the costs of running two tracks on the same street.

Tables 6.22 and 6.23, in the Appendix to this chapter, provide estimated capital costs for light rail and BRT on each alignment based on the costs from the GAO study. Using these figures, the cost of constructing light rail in the study area ranges from a low of $85.5 million to a high of $891.2 million. By comparison, the cost of improvements to facilitate bus rapid transit range from $1.3 million to $72.0 million, while costs for the construction of exclusive busways range from $51.3 million to $412.5 million.

Using the more conservative METRO figures, the costs for light rail range from $41.4 million to $187.5 million (bus rapid transit costs were not addressed in the METRO report). The construction of six stations, which are quoted separately in the METRO report, would add $3.0 million in costs based on METRO's estimate of $500,000 per station (not elevated). Finally, based on more recent cost estimates developed during the construction of Houston's starter line, capital costs for light rail in the study area would range from $298.1 million to $324 million.

Operating costs per revenue mile from the GAO study were used to obtain an estimate of the potential costs associated with running light rail or bus rapid transit in the study area. Applying GAO figures to the total length of the two alignments, operating costs for light rail range from a low of $28.98 per mile to a high of $117 per mile. Costs for bus rapid transit run between $12.01 and $63.90 per mile in the study area.

To arrive at an annual operating cost per mile, operating costs per revenue mile are typically factored by the frequency of service (i.e., the number of vehicles in operation on a given route each day multiplied by the number of days the route is served). In the absence of specific information regarding service to the Inner Katy study area, **Table 6.24** in the Appendix to this chapter presents the cost of a single vehicle to travel one mile on each of the alignments for each mode. For light rail, the one-mile operational cost ranges from a low of $28.98 (on Alignment C) to a high of $117.00 (on Alignment B). The low cost for BRT is $12.01 per mile (on Alignment C), and $63.90 (on Alignment B) is the high cost.

While bus rapid transit is substantially less costly to implement than light rail, LRT may be preferable as the long-term transit mode for Inner Katy given doubts about the ridership "attractiveness" of BRT. Furthermore, BRT may have less influence on developer decisions since it is perceived as a less permanent investment, subject to possible relocation of routes and transit stops.

Benefits

Tax revenues are frequently used as a measure of the benefit derived from public investment. As in Chapter 4-Baseline Opportunities Analysis, the following analysis

addresses sales tax and property tax revenues that could be generated within the study area as a whole. This analysis does not address economic impacts associated with the construction and operation of the transit system itself. Such impacts would include spending generated by salaries paid to workers, as well as taxes and fees generated during system construction and operation. Given the magnitude of the construction costs and the length of time over which the construction would take place, these impacts would likely be substantial. These kinds of considerations are typically addressed during the broader federal approval process.

Sales Tax

Increased sales tax revenue would be generated by redevelopment of the Inner Katy area in two ways: 1) by new residents shopping at existing retail establishments, and 2) by new and existing residents shopping at new retail outlets. Although specific types of establishments cannot be gauged by the conceptual redevelopment model, averages can be used to estimate future retail sales in broad terms (see **Table 6.25** in the Appendix to this chapter).

To estimate the amount of square footage by category that could be expected in the area, the percentage of total under-roof square footage in Texas for each type of retail establishment—supermarket (45.5 percent), convenience store (1.7 percent), and department store (52.7 percent)—was applied to the square footage of retail derived by the redevelopment model in Chapter 5. Warehouse clubs and superstores were excluded due to a lack of data, as well as the difficulty of assembling sufficient land within the study area for this scale of establishment. For each of the major retail categories above, the estimated square footage was multiplied by sales per square foot (see Table 6.P in the Appendix) to estimate retail sales. As illustrated in **Table 6.26**, the additional retail development potential afforded by Alignment B, Scenario 2, suggests higher sales tax revenues.

According to quarterly sales tax reports published by the Texas Comptroller of Public Accounts, 47.6 percent of all retail sales in Harris County in 2000 were taxable. Using this figure, the additional retail establishments proposed in the Inner Katy development scenarios would generate between $14.6 million (for Alignment C, Scenario 1) and $35.2 million (under Alignment B, Scenario 2) in new sales tax revenue.

In addition to estimating sales tax revenues generated by new establishments, estimates can also be calculated based on the influx of population associated with new development. Sales tax data from the Comptroller of Public Accounts and population estimates from the U.S. Census Bureau were used to calculate an estimate of $6,693 in taxable retail sales per person for Harris County in 2001 (see **Table 6.27** in the Appendix to this chapter).

This per capita figure was applied to the population estimates calculated in Table 6.2 to arrive at an estimate of the amount of retail sales that might be generated by the influx of residents to the Inner Katy area (see **Table 6.28** in the Appendix to this chapter). Sales estimates ranged from a low of $132 million (generated by an increase of 19,715 residents in the study area under Alignment C, Scenario 1) to a high of $644 million (based on the addition of 96,252 people under Alignment B,

Scenario 2). This would represent an increase in state and local sales tax revenues of between $10.9 million and $53.1 million. *[Note that these figures cannot be added to the earlier revenue estimates for new establishments because the two are not mutually exclusive.]*

This analysis does not attempt to identify whether these dollars represent new spending or merely the shifting of spending from one area of the city to another. However, it is likely that at least a portion of the incoming population would be drawn to the area from outside the city. These new residents would cause a net increase in tax revenues and not just a shift of revenue from one area to another. The introduction of new retail development in the area would also generate new tax revenues. As with population increases, this new development may represent a shift in development that would have occurred elsewhere in the city.

Property Tax

Exact estimates of the property tax revenue that would be generated by the Inner Katy development scenarios could not be calculated due to: 1) the complexity of the property tax system, and 2) a lack of data about specific structures that might be built in the area. However, estimates of the property values that might result were prepared using construction costs as a proxy for appraised value. Through this method (see details in the Appendix to this chapter), the value of new development along Alignment B was estimated at $1.6 billion to $2.1 billion, with approximately $800 million occurring within one-quarter mile of transit stations, as would be expected under a transit-oriented development scenario.

Table 6.7 presents the total square footage by major development types (residential, retail, office and industrial) that would be constructed under each of the Inner Katy scenarios. As shown in **Table 6.8**, the highest overall property values are generated by Alignment B, Scenario 2. The value of new development around transit stations is slightly higher along Alignment B, Scenario 1.

TABLE 6.7:
Square Footage by Development Type

Alignment/ Scenario	Square Footage				
	Residential	Retail	Office	Industrial	TOTAL
B/1	21,005,233	2,664,615	1,669,234	1,117,344	*26,456,427*
B/2	29,395,147	3,151,555	721,839	-	*33,268,543*
C/1	13,913,392	1,304,589	104,536	-	*15,322,518*
C/2	21,305,328	2,180,752	497,328	-	*23,983,410*
TOTAL	85,619,100	9,301,511	2,992,937	1,117,344	***99,030,892***

Source: Fregonese Calthorpe Associates

TABLE 6.8:
Estimated Property Values

	Scenario	Estimated Value of New Development	
		Full Alignment	Within Quarter-Mile of Stations
Alignment B	1	$1,631,086,519	$835,354,255
	2	$2,075,718,576	$788,514,572
Alignment C	1	$912,075,619	$531,239,778
	2	$1,488,352,698	$769,045,066

Source: Calculated by Fregonese Calthorpe Associates

Wages and Income

The large tracts of industrial land along Alignment B present the opportunity for light industrial or large-scale office development not available along Washington Avenue. Given the higher wages afforded by these types of jobs, Alignment B, Scenario 1 provides the greatest potential for creating higher-wage jobs.

Table 6.9 shows the number of employees by development type based on the data generated by the scenario modeling. The opportunities for industrial development presented by Alignment B greatly increase the employment potential for the study area.

TABLE 6.9:
Estimated Employment by Development Type

	Scenario	Retail	Office	Industrial	Total Employment
Alignment B	1	4,427	4,159	1,117	9,703
	2	4,767	1,320	—	6,087
Alignment C	1	2,174	261	—	2,435
	2	3,421	1,029	—	4,450

Source: Calculated by TIP Development Strategies, Inc. based on data provided by Fregonese Calthorpe Associates

Average weekly wages in Harris County in 2000 were obtained from the U.S. Bureau of Labor Statistics' *Covered Employment & Wages* program for each of the three major sectors represented by the development types: retail, services and manufacturing (see **Table 6.29** in the Appendix to this chapter). Although all three sectors include some lower-wage jobs, manufacturing and high-end service jobs clearly provide the

greatest opportunity for higher wages in the area. In light of this fact, Alignment B, Scenario 1 would offer the greatest potential for increasing wages due to the opportunity it presents for industrial and office development.

Each of the potential high-capacity transit alignments crosses through a mix of income levels, according to tract-level data from the 2000 Census released in September 2002. Alignment C ranges from the highest income levels of the study area near Memorial Park (Tract 5108) to the lowest (Tract 5101, which is bordered by Sabine Street on the east and IH 45 on the west). Alignment B borders the relatively affluent Houston Heights neighborhood (Tract 5103), as well as lower-income neighborhoods along Shepherd Drive (Tract 5105). The introduction of transit-oriented development along either alignment could serve to raise income levels throughout the area.

Economic Diversification

Diversification of the economic base of the Inner Katy area should be a consideration in the decision to invest in high-capacity transit. Transit-oriented development provides the opportunity to create a broader and stronger retail mix in the area, regardless of alignment. However, the additional office and industrial development suggested by Alignment B could provide the opportunity to capitalize on the study area's proximity to downtown and could help to reverse the trend of professional services and light industry moving away from the central business district. Brownfield mitigation issues, which appear more significant along Alignment B given the historical industrial activity in this area, may offset these benefits in the short term. However, as discussed in Chapter 4, Alignment B does not appear to face the same land assembly challenges that Alignment C would pose, given the extent of small, shallow lots along Washington Avenue.

A community can increase its tax base and add jobs without building a sustainable economy. This is a potential outcome to which the Inner Katy study area is particularly vulnerable. Given this possibility, a diversified economic base is the best means to achieving transit-oriented development. In turn, the goal of economic diversification should influence the choice of transit alignment.

A broader and stronger retail mix within the study area is a reasonable prospect of high-capacity transit, particularly light rail. Loss of retail sales to suburban malls has long plagued downtown and central-city areas, and light rail can help reverse this trend. This became apparent relatively quickly in both Portland and Dallas. Investment in shopping centers outside of central cities is a function of developer costs, linked not only, or even primarily, to land costs but to ease of access and parking. LRT makes access possible without having to worry about parking, offering the possibility of reduced automobile use along with new retail options for area residents.

However, diversification should not address only the retail mix. Professional service opportunities can be enhanced in light rail associated development. For example, engineering and architectural services, real estate companies and design studios (some of which are already occurring in the Inner Katy area) provide a healthy economic mix. The concentration of these sectors closer to downtown, and served by rail, would both benefit

the area and help offset increasing growth and investment outside Harris County (as illustrated by the shift-share analysis conducted for this study, which is discussed in the Appendix to this chapter along with explanation of a diversification index). Renewed central-city development would also help arrest a trend toward greater commuting distances.

In addition, other development types, such as live/work units, would further expand opportunitities for professional services. Specialty service companies, including artist studios and neighborhood-oriented accounting firms, can absorb space even with high vacancy rates in nearby downtown Houston.

The Inner Katy area already offers "close-in" locations, which could be further enhanced by proximity to high-capacity transit service.

Another option for economic diversification is in manufacturing and technology-related companies, although only a minimal impact can be expected from these sectors. In fact, the introduction of high-capacity transit may eventually move manufacturing facilities out of the area due to increasing property costs. LRT is not a good incentive for retaining manufacturing businesses, nor would it provide a sufficient incentive for location of new manufacturing operations in the area.

When considering economic diversification, it should be remembered that the Inner Katy area does not exist in a vacuum. Specific alignments would have local as well as regional effects. These effects can be positive or negative, reflecting national economic trends or redirecting growth from one area to another. The value of diversification, however, is independent of national factors. It is a desirable end in itself.

APPENDIX A: Additional Data Tables

TABLE 6.10:
Population Growth Derived from Scenario Modeling

	Scenario	New Households	Estimated Additional Population Based on Persons per Household			
			1.56 *(study area low)*	2.33 *(study area average)*	3.39 *(study area high)*	2.79 *(Harris Co. average)*
Alignment B	**1**	**18,307**	28,559	42,655	62,061	51,077
	2	**28,393**	44,293	66,156	96,252	79,216
Alignment C	**1**	**12,638**	19,715	29,447	42,843	35,260
	2	**20,224**	31,549	47,122	68,559	56,425

Source: Persons per household data from U.S. Census Bureau (the low, average and high figures are from the 10 Census tracts that approximate the Inner Katy area).
Estimated population calculated by TIP Development Strategies, Inc.

TABLE 6.11:
Annual Growth Over 20-, 30- and 40-Year Planning Horizons

Maximum / Minimum Added based on Development Scenarios *(from Tables 6.1 and 6.2)*			Number Added per Year Over Planning Horizons		
			20 years	*30 years*	*40 years*
Households	minimum	12,638	632	421	316
	maximum	28,393	1,420	946	710
Population	minimum	19,715	986	657	493
	maximum	96,252	4,813	3,208	2,406
Employment	minimum	2,435	122	81	61
	maximum	9,703	485	323	243

Source: Calculated by TIP Development Strategies based on modeling data from Fregonese Calthorpe Associates: *Households*—minimum of 12,638 in Alignment C, Scenario 1; maximum of 28,393 from Alignment B, Scenario 2. *Population*—minimum of 19,715 based on Alignment C, Scenario 1 with 1.56 people per household; maximum of 96,252 based on Alignment B, Scenario 2 with 3.39 people per household. *Employment*—minimum of 2,435 from Alignment C, Scenario 1; maximum of 9,703 from Alignment B, Scenario 1.

TABLE 6.12:
Population Growth in Houston PMSA and Component Counties: 1990 to 2000

	Census		Change 1990 to 2000	
	1990	2000	Numeric	Percent
Houston, TX PMSA	3,322,025	4,177,646	855,621	25.8%
Chambers County	20,088	26,031	5,943	29.6%
Fort Bend County	225,421	354,452	129,031	57.2%
Harris County	2,818,199	3,400,578	582,379	20.7%
Liberty County	52,726	70,154	17,428	33.1%
Montgomery County	182,201	293,768	111,567	61.2%
Waller County	23,390	32,663	9,273	39.6%

Source: U.S. Census Bureau

TABLE 6.13:
Population Projections for Houston PMSA and Harris County: 2000 to 2020

	2000	2020	Change 2000 to 2020	
			Numeric	Percent
Houston PMSA	4,177,646	5,760,656	1,583,010	37.9%
Chambers County	26,031	37,328	11,297	43.4%
Fort Bend County	354,452	557,407	202,955	57.3%
Harris County	3,400,578	4,541,661	1,141,083	33.6%
Liberty County	70,154	94,898	24,744	35.3%
Montgomery County	293,768	478,187	184,419	62.8%
Waller County	32,663	51,175	18,512	56.7%

Source: Texas State Data Center, *One-Half 1990-2000 Migration Scenario*

TABLE 6.14:
H-GAC Population Estimates and Forecasts for Selected RAZs: 1990 to 2025

Regional Analysis Zone	1990	1995	2000	2005	2010	2015	2020	2025
7	10,633	10,775	11,733	11,901	12,398	13,009	13,745	14,562
8	32,134	32,650	33,377	33,291	33,833	33,334	32,881	32,475
26	4,527	4,851	5,229	5,447	5,677	5,602	5,536	5,478
27	16,931	16,950	17,073	16,808	16,870	17,104	17,505	18,004
42	4,218	4,602	5,052	5,326	5,691	6,103	6,013	5,931
Total	**68,442**	**69,828**	**72,463**	**72,773**	**74,469**	**75,153**	**75,680**	**76,450**
% change from prior period		**2.0%**	**3.8%**	**0.4%**	**2.3%**	**0.9%**	**0.7%**	**1.0%**

Source: Houston-Galveston Area Council, 1999 update to *Small Area Allocation Forecast 1990 - 2020*, Release One

H-GAC forecasts population, households and employment for 199 Regional Analysis Zones (RAZs) within the eight-county Houston-Galveston-Brazoria consolidated metropolitan statistical area (CMSA). RAZs are comprised of single Census tracts and groups of tracts. The Inner Katy area is not contiguous with any of the RAZs. However, the 10 Census tracts that approximate the study area are contained in all or part of five separate zones. **Table 6.14** above presents H-GAC's population forecasts for this five-zone area (RAZs 7, 8, 26, 27 and 42). The total population of the five zones is almost twice that of the 10 Census tracts that approximate the study area. Therefore, this RAZ data is not intended to serve as a population projection for Inner Katy, but rather as a gauge of the degree of growth that H-GAC anticipates in the general area.

TABLE 6.15:
Population and Housing Units in Selected Census Tracts: 1990 to 2000

2000 Census Tract (and 1990 equivalent)	1990 Census		2000 Census		Change 1990-2000			
					Population		Housing Units	
	Population	Housing Units	Population	Housing Units	Number	Percent	Number	Percent
5101 (504)	2,324	812	2,150	635	-174	-7.5%	-177	-21.8%
5102 (505.02)	2,157	816	2,693	1,442	536	24.8%	626	76.7%
5103 / 5104 (505.01, 506.01, 506.02)	9,701	5036	8,803	4,688	-898	-9.3%	-348	-6.9%
5105 (514.01)	3,149	1,388	2,977	1,365	-172	-5.5%	-23	-1.7%
5106 (514.02, 516.02)	3,665	1381	3,801	1,268	136	3.7%	-113	-8.2%
5107 (515.02)	2,424	1,411	2,168	1,389	-256	-10.6%	-22	-1.6%
5108 (515.01)	4,500	2,468	4,688	3,060	188	4.2%	592	24.0%
5109 (516.01)	4,427	1,590	4,725	1,548	298	6.7%	-42	-2.6%
5201 (442.02)	1,578	600	1,615	591	37	2.3%	-9	-1.5%
TOTAL	**33,925**	**15,502**	**33,620**	**15,986**	**-305**	**-0.9%**	**484**	**3.1%**

Source: U.S. Census Bureau

TABLE 6.16:
Household Projections for Houston PMSA and Harris County: 2000 to 2020

	Households in 2000	Households in 2020	Change 2000 to 2020	
			Numeric	Percent
Houston PMSA	1,519,697	2,100,312	580,615	38.2%
Chambers County	8,837	12,508	3,671	41.5%
Fort Bend County	117,145	206,828	89,683	76.6%
Harris County	1,246,076	1,621,113	375,037	30.1%
Liberty County	25,800	39,899	14,099	54.6%
Montgomery County	110,394	200,635	90,241	81.7%
Waller County	11,445	19,329	7,884	68.9%

Source: Houston-Galveston Area Council, 1999 update to *Small Area Allocation Forecast 1990 - 2020,* Release One

TABLE 6.17:
H-GAC Household Estimates and Forecasts for Selected RAZs: 1990 to 2025

Regional Analysis Zone	1990	1995	2000	2005	2010	2015	2020	2025
7	3,548	3,667	4,057	4,153	4,384	4,664	4,998	5,369
8	13,073	13,590	14,127	14,266	14,727	14,736	14,766	14,810
26	2,061	2,261	2,480	2,616	2,769	2,771	2,776	2,784
27	6,808	6,969	7,134	7,105	7,238	7,451	7,745	8,088
42	1,406	1,571	1,755	1,876	2,038	2,223	2,227	2,234
Total	**26,896**	**28,058**	**29,553**	**30,016**	**31,156**	**31,845**	**32,512**	**33,286**
% change from prior period		**4.3%**	**5.3%**	**1.6%**	**3.8%**	**2.2%**	**2.1%**	**2.4%**

Source: Houston-Galveston Area Council, 1999 update to *Small Area Allocation Forecast 1990 - 2020,* Release One

TABLE 6.18:
Employment Estimates Derived from Scenario Modeling

	Scenario	Employment	Number Added per Year Over Planning Horizons		
			20 years	*30 years*	*40 years*
Alignment B	**1**	**9,703**	485	323	243
	2	**6,087**	304	203	152
Alignment C	**1**	**2,435**	122	81	61
	2	**4,450**	223	148	111

Source: Fregonese Calthorpe Associates

TABLE 6.19:
H-GAC Employment Estimates / Forecasts for Selected RAZs: 1999 to 2025

Regional Analysis Zone	1999	2000	2005	2010	2015	2020	2025
7	14,229	14,229	14,229	14,229	14,229	14,229	14,229
8	15,629	15,684	15,776	15,855	15,911	15,957	15,999
26	5,003	5,069	5,178	5,274	5,342	5,400	5,451
27	30,321	30,513	30,835	31,114	31,315	31,480	31,628
42	21,201	21,694	22,544	23,300	23,854	24,316	24,737
Total	**86,383**	**87,189**	**88,562**	**89,772**	**90,652**	**91,382**	**92,044**
% change from prior period		0.9%	1.6%	1.4%	1.0%	0.8%	0.7%

Source: Houston-Galveston Area Council, 1999 update to *Small Area Allocation Forecast 1990 - 2020*, Release One

TABLE 6.20:
Operating Costs from GAO Study

	Light Rail	Bus Rapid Transit *(all forms)*
Operating cost per unlinked passenger trip		
Low	$1.19	$0.31
High	$4.07	$5.60
Operating cost per revenue mile		
Low	$4.20	$1.74
High	$15.60	$8.52

Source: General Accounting Office, *Mass Transit: Bus Rapid Transit Shows Promise,* GAO-01-984, September 2001. All costs were escalated to Year 2000 dollars.

NOTE:
Operating costs were obtained for the six cities in which both LRT and BRT systems were operated.

Unlinked passenger trips *are the number of passengers who board public transportation vehicles. Passenger are counted each time they board vehicles no matter how many vehicles they use to travel from their origin to their destination.*

Costs per unlinked passenger trip *are based on the total annual operating cost divided by the total annual passenger boardings; they are a reflection of the costs to carry a person on a trip regardless of trip length.*

Cost per revenue mile *calculates the average cost of the vehicles to travel one mile while in passenger service. It is calculated by dividing a vehicle's annual operating costs by the total annual number of miles traveled.*

TABLE 6.21:
Planned Capital Improvements in Inner Katy: FY 2002 to 2006

Project Name	Budgeted Amount *(in thousands)*					
	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	TOTAL 2002-06
West End Health Center and Multi-Service Center Renovation	$2,620 DCOR				$600 DCOR	$3,220 DCOR
Municipal Courts Expansion-Modernization (corner of Houston & Washington)	$500 C	$1,000 C		$1,000 CO	$1,000 CO	$3,500 CO
Courtroom HVAC Retrofit in Municipal Courts Building	$935 DC	$1,100 C	$1,100 C			$3,135 DC
Cottage Grove Storm Sewer System			$130 D	$1,200 C		$1,330 DC
Sixth Street W. Paving: Yale Street to Shepherd			$250 D	$2,000 C		$2,250 DC
Yale Reconstruction: IH 10 to IH 610		$700 D	$5,300 C			$6,000 DC
Washington-Westcott Circle	$250 D	$1,000 C				$1,250 DC
11th Street Paving: Heights Blvd. to Studewood					$525 AD	$525 AD
Studewood Reconstruction: White Oak Bayou to 20th Street	$7,036 C					$7,036 C
TOTAL	**$11,341**	**$3,800**	**$6,780**	**$4,200**	**$2,125**	**$28,246**

A = acquisition
D = design
C = construction
O = other
R = art

Source: Office of District H Council Member Gabriel Vasquez, July 2002

TABLE 6.22:
Capital Cost Estimates for Light Rail from Selected Sources

	Cost per mile for Light Rail	Alignment B *(7.5 miles)*	Alignment C *(6.9 miles)*
GAO Study *(in millions)*			
Low	$12.39	$92.9	$85.5
Average	$34.79	$260.9	$240.1
High	$118.83	$891.2	$819.9
METRO figures *(in millions)*			
Paved	$10.5	$78.8	$72.5
Ballasted	$6.0	$45.0	$41.4
Elevated (aerial)	$25.0	$187.5	$172.5
"Downtown to Dome" Starter Line costs *(in millions)*			
Average	$43.2	$324.0	$298.1

Source: Calculated by TIP Development Strategies based on figures from the General Accounting Office presented in Table 6.6.

TABLE 6.23:
Capital Cost Estimates for Bus Rapid Transit
(in millions of dollars)

	Busways			Improvements to Existing Arterials		
	Cost per mile	Alignment B *(7.5 miles)*	Alignment C *(6.9 miles)*	Cost per mile	Alignment B *(7.5 miles)*	Alignment C *(6.9 miles)*
Low	$7.43	$55.73	$51.27	$0.19	$1.4	$1.3
Average	$13.49	$101.18	$93.08	$0.68	$5.1	$4.7
High	$55.00	$412.50	$379.50	$9.60	$72.0	$66.2

Source: Calculated by TIP Development Strategies based on GAO figures in Table 6.6.

TABLE 6.24:
Estimated Operating Cost per Revenue Mile

	Light Rail			Bus Rapid Transit *(all forms)*		
	From GAO Study	Alignment B *(7.5 miles)*	Alignment C *(6.9 miles)*	From GAO Study	Alignment B *(7.5 miles)*	Alignment C *(6.9 miles)*
Operating cost per revenue mile						
Low	$4.20	$31.50	$28.98	$1.74	$13.05	$12.01
High	$15.60	$117.00	$107.64	$8.52	$63.90	$58.79

Source: Calculated by TIP Development Strategies based on GAO figures in Table 6.6.

TABLE 6.25:
Sales per Establishment and per Square Foot for Selected Types of Retail Businesses in the U.S. and Texas: 1997

	Number of Establish-ments	Total Sales *(in thousands of dollars)*	Total Under-Roof Floor Space *(in thousands of square feet)*	Sales per Establish-ment	Sales per Square Foot
United States					
Supermarkets & other grocery (except convenience) stores	69,461	$351,402,705	969,342	$5,058,993	$363
Convenience stores	27,081	$16,847,766	48,548	$622,125	$347
Department stores	10,366	$220,108,157	1,086,552	$21,233,664	$203
Warehouse clubs & superstores	1,530	$81,918,756	227,029	$53,541,671	$361
Texas					
Supermarkets & other grocery (except convenience) stores	4,716	$25,738,554	68,335	$5,457,709	$377
Convenience stores	1,517	$819,524	2,582	$540,227	$317
Department stores	721	$16,104,491	79,116	$22,336,326	$204
Warehouse clubs & superstores	142	*suppressed*	*suppressed*	*NA*	*NA*

Source: U.S. Bureau of the Census, 1997 Economic Census, *Retail Trade—Subject Series*, Table 8

TABLE 6.26:
Estimated Square Footage and Sales by Retail Type

	Alignment/Scenario			
	B/1	B/2	C/1	C/2
Square Footage of Retail from Model	2,664,615	3,151,555	1,304,589	2,180,752
Supermarkets				
Estimated Square Footage	1,212,400	1,433,958	593,588	992,242
Estimated Sales (based on $377/sq ft)	$457,074,734	$540,601,987	$223,782,674	$374,075,294
Convenience Stores				
Estimated Square Footage	45,298	53,576	22,178	37,073
Estimated Sales (based on $317/sq ft)	$14,359,610	$16,983,730	$7,030,430	$11,752,073
Department Stores				
Estimated Square Footage	1,404,252	1,660,869	687,518	1,149,256
Estimated Sales (based on $204/sq ft)	$286,467,429	$338,817,375	$140,253,754	$234,448,286
Total Retail				
Estimated Square Footage	2,661,950	3,148,403	1,303,284	2,178,571
Total Estimated Sales	$757,901,774	$896,403,092	$371,066,858	$620,275,653
Total Est. Taxable Sales (47.6 % of Total Est. Sales)	$360,761,244	$426,687,872	$176,627,825	$295,251,211
Estimated State and Local Sales Tax Revenue	$29,762,803	$35,201,749	$14,571,796	$24,358,225

Source: Percent of total square footage and sales per square foot were calculated from the 1997 Economic Census data for Texas presented in Table 6.25. These figures were then applied to estimated square footage of retail developed by Fregonese Calthorpe Associates.

TABLE 6.27:
Estimated Taxable Sales per Capita in Harris County: 2001

Sales Subject to State Tax (Retail Industries) *2001*	Estimated Population Harris County *2001*	Estimated Taxable Retail Sales per Capita
$23,161,741,364	3,460,589	$6,693

Source: *Amount Subject to State Tax* from Texas Comptroller of Public Accounts; *Estimated Population of Harris County* from U.S. Census Bureau; *Estimated Taxable Retail Sales per Capita* calculated by TIP Development Strategies, Inc.

TABLE 6.28:
Estimates of Taxable Retail Sales in Inner Katy based on Persons Per Household

Persons per Household	Alignment/Scenario			
	B/1	B/2	C/1	C/2
1.56 *(study area low)*				
Estimated Population	28,559	44,293	19,715	31,549
Estimated Taxable Retail Sales *(in millions)*	$191	$296	$132	$211
2.33 *(study area average)*				
Estimated Population	42,655	66,156	29,447	47,122
Estimated Taxable Retail Sales *(in millions)*	$285	$443	$197	$315
3.39 *(study area high)*				
Estimated Population	62,061	96,252	42,843	68,559
Estimated Taxable Retail Sales *(in millions)*	$415	$644	$287	$459
2.79 *(Harris County average)*				
Estimated Population	51,077	79,216	35,260	56,425
Estimated Taxable Retail Sales *(in millions)*	$342	$530	$236	$378

Source: *Retail Sales* calculated by TIP Development Strategies based on population estimates presented in Table 6.2.

TABLE 6.29:
Average Weekly Wages for Major Industry Sectors in Harris County: 2000

	Average Weekly Wage in 2000		
	Lowest	**Highest**	***Median***
Manufacturing	$405 *Textile Mill Products*	$1,135 *Industrial Machinery & Equipment*	$766
Retail	$263 *Eating & Drinking Places*	$692 *Automotive Dealers & Service Stations*	$335
Services	$279 *Motion Pictures (includes movie theaters & video rental stores)*	$2,746 *Security & Commodity Brokers*	$726

Source: U.S. Bureau of Labor Statistics, Covered Employment and Wages program. Medians were estimated by TIP Development Strategies, Inc.

Note: Higher wages were reported for two manufacturing industries: *Chemicals and Allied Products* (SIC 28) and *Petroleum and Coal Products* (SIC 29). However, these industries were excluded from this analysis as they would not be likely to locate in the Inner Katy study area.

APPENDIX B: Method for Estimating Appraised Value from Development Construction Costs

Construction costs include the cost of acquisition and demolition, as well as the cost of constructing parking and the buildings themselves. The cost of constructing the buildings suggested by the Inner Katy development scenarios was calculated using an estimated cost of construction per square foot for each land use within each development type.

For example, the *Low-Rise Retail/Residential* building type was defined in each scenario as a three-story building containing 33 percent retail uses and 67 percent residential uses. The estimated construction costs for this development type are $57.55 per square foot for residential uses and $61.00 per square foot for retail. The cost of constructing an individual building was calculated by applying these rates to the appropriate percentage of the total building square footage. Using this approach, a 100,000 square foot low-rise retail/residential structure would have a construction value of $586.9 million as illustrated below:

Retail uses:	((100,000 x 0.33) x $61.00) =	$201,300,000
Residential uses:	((100,000 x 0.67) x $57.55) =	$385,585,000
		$586,885,000

APPENDIX C: Diversification Index Methodology

Employment data for 2000 from the U.S. Bureau of Labor Statistics *Covered Employment & Wages* program was used to analyze the current employment base of Harris County. The purpose of the analysis was to identify the types of businesses within the suggested Inner Katy development scenarios that would best enhance the overall employment mix in the Houston area.

Two common analytical techniques, *location quotients* and *shift-share analysis*, were employed in this task. A location quotient (LQ) is a ratio typically used to measure the concentration of employment in an industry in one location relative to its concentration in another geographical area (in this case, the state of Texas). LQs are useful for assessing the relative size and presence of an industry in a given area. Generally, an LQ greater than 1.00 is considered to be an indication that a particular industry sector is well developed in a region. For economic development purposes, however, a higher threshold of 1.25 is often used to increase the likelihood of identifying industries with export potential (i.e., those that are producing enough of their product or service to serve customers outside the immediate market area).

Industry sectors identified in the location quotient analysis are then assessed for their overall performance and growth potential using a shift-share analysis. Shift-share analysis is a comparative tool used to measure the economic linkages between changes in the structure of a local economy and that of a higher-level or "parent" economy, in this case the entire state. Shift-share analysis attempts to determine the source of changes in a particular local industry by allocating shifts in employment among three components: state or national, industry mix, and regional competitive share.

The *state share* looks at the change in employment in the region that results from overall growth or decline in the parent economy. The *industry mix* share shows the degree of change within a local industry that is due to changes in the same industry on a national basis. A particular industry may be expanding or contracting at a rate that varies from rates in other industries or the nation as a whole. The *regional competitive* share attempts to capture the extent of influence that a locale's unique economic circumstances contribute to employment growth or decline in a specific industry. Such factors can include excellent or poor natural resources, input availability, workforce, climate, cost considerations, or infrastructure, among others. The idea is simply that, if local industry growth exceeds that of its peers around the state or the nation, it is likely that some competitive advantage is being reflected. If local growth lags, there is likely a negative pattern. A negative regional competitive share would indicate that the industry within the region has not kept pace with growth in the industry at the macro level.

The analysis was conducted at the 3-digit SIC code level. Industries were then grouped into three major sectors: retail, services and manufacturing. Highlights from the analysis of each sector are presented in **Tables 6.30, 6.31 and 6.32**.

*The abbreviation "**SIC**" refers to the 1987 **Standard Industrial Classification** system, the federal system for classifying business activities in the U.S. economy.*

TABLE 6.30:
Analysis of Employment Data for Harris County: Retail Sector

SIC Code and Description	Harris County Employment				Shift-Share Analysis		
	1997	2000	% Change 1997-00	LQ in 2000	State	Industry	Local
Ten Highest Retail Sector Location Quotients (LQs) in 2000							
542 Meat and Fish Markets	787	1,043	32.5%	1.64	75	84	97
555 Boat Dealers	424	936	120.8%	1.47	40	161	310
533 Variety Stores	847	1,691	99.6%	1.46	81	36	727
564 Children's and Infants' Wear Stores	663	1,137	71.5%	1.35	63	366	44
565 Family Clothing Stores	8,058	9,165	13.7%	1.33	768	694	-356
561 Men's & Boys' Clothing Stores	1,313	1,623	23.6%	1.32	125	21	164
546 Retail Bakeries	2,472	2,283	-7.6%	1.32	236	-353	-71
559 Automotive Dealers, NEC	*suppressed*	322	*N/A*	1.28	*N/A*	*N/A*	*N/A*
539 Misc. General Merchandise Stores	2,953	4,768	61.5%	1.21	282	325	1,208
569 Misc. Apparel & Accessory Stores	1,125	1,014	-9.9%	1.15	107	-538	319
Ten Lowest Retail Sector Location Quotients (LQs) in 2000							
554 Gasoline Service Stations	5,392	4,836	-10.3%	0.75	514	-905	-165
549 Miscellaneous Food Stores	670	576	-14.0%	0.74	64	33	-191
592 Liquor Stores	791	927	17.2%	0.73	75	-43	103
531 Department Stores	27,598	28,427	3.0%	0.72	2,631	-190	-1,612
544 Candy, Nut, and Confectionery Stores	248	230	-7.3%	0.67	24	106	-148
556 Recreational Vehicle Dealers	*suppressed*	285	*N/A*	0.65	*N/A*	*N/A*	*N/A*
545 Dairy Products Stores	*suppressed*	12	*N/A*	0.64	*N/A*	*N/A*	*N/A*
527 Mobile Home Dealers	508	583	14.8%	0.59	48	48	-22
598 Fuel Dealers	289	317	9.7%	0.45	28	-40	41
596 Nonstore Retailers	1,327	1,245	-6.2%	0.31	127	283	-492

Source: U.S. Bureau of Labor Statistics, *Covered Employment & Wages.*
Location quotients (LQ) and shift-share analysis calculated by TIP Development Strategies, Inc.

TABLE 6.31:
Analysis of Employment Data for Harris County: Services Sector

SIC Code and Description	Harris County Employment				Shift-Share Analysis		
	1997	2000	% Change 1997-00	LQ in 2000	State	Industry	Local
Ten Highest Services Sector Location Quotients (LQs) in 2000							
752 Automobile Parking	1,357	1,955	44.1%	2.37	129	259	210
824 Vocational Schools	*suppressed*	4,187	*N/A*	2.01	*N/A*	*N/A*	*N/A*
732 Credit Reporting and Collection	5,472	6,578	20.2%	1.99	522	875	-291
871 Engineering & Architectural Services	32,377	37,560	16.0%	1.98	3,086	4,416	-2,319
671 Holding Offices	1,780	1,700	-4.5%	1.98	170	122	-372
822 Colleges and Universities	10,847	12,238	12.8%	1.87	1,034	434	-77
725 Shoe Repair and Shoeshine Parlors	143	124	-13.3%	1.80	14	-46	13
764 Reupholstery and Furniture Repair	*suppressed*	571	*N/A*	1.79	*N/A*	*N/A*	*N/A*
899 Services, NEC	1,240	1,321	6.5%	1.72	118	207	-244
734 Services to Buildings	20,939	24,243	15.8%	1.65	1,996	124	1,184
Ten Lowest Services Sector Location Quotients (LQs) in 2000							
603 Savings Institutions	2,327	1,084	-53.4%	0.57	222	-279	-1,186
633 Fire, Marine, and Casualty Insurance	4,901	4,252	-13.2%	0.53	467	-105	-1,012
861 Business Associations	665	684	2.9%	0.52	63	-6	-38
839 Social Services, NEC	484	646	33.5%	0.45	46	45	71
632 Medical Service and Health Insurance	1,442	1,102	-23.6%	0.44	137	-246	-231
805 Nursing and Personal Care Facilities	8,184	8,611	5.2%	0.42	780	-581	228
703 Camps and Recreational Vehicle Parks	119	215	80.7%	0.42	11	11	74
803 Offices of Osteopathic Physicians	259	283	9.3%	0.39	25	-23	22
614 Personal Credit Institutions	1,919	1,726	-10.1%	0.35	183	213	-589
865 Political Organizations	32	23	-28.1%	0.16	3	26	-38

Source: U.S. Bureau of Labor Statistics, *Covered Employment & Wages.*
Location quotients (LQ) and shift-share analysis calculated by TIP Development Strategies, Inc.

TABLE 6.32:
Analysis of Employment Data for Harris County: Manufacturing Sector

SIC Code and Description	Harris County Employment				Shift-Share Analysis		
	1997	2000	% Change 1997-00	LQ in 2000	State	Industry	Local
Ten Highest Manufacturing Sector Location Quotients (LQs) in 2000							
351 Engines and Turbines	1,154	1,334	15.6%	3.93	110	12	58
339 Miscellaneous Primary Metal Products	806	735	-8.8%	2.91	77	-176	29
287 Agricultural Chemicals	1,965	1,611	-18.0%	2.46	187	-317	-224
353 Construction and Related Machinery	17,914	17,213	-3.9%	2.39	1,708	-3,243	834
305 Hose & Belting & Gaskets & Packing	1,575	1,732	10.0%	2.37	*N/A*	*N/A*	*N/A*
349 Misc. Fabricated Metal Products	9,768	9,190	-5.9%	2.12	931	-952	-557
282 Plastics Materials and Synthetics	5,197	5,267	1.3%	2.09	495	-247	-178
259 Miscellaneous Furniture and Fixtures	385	1,573	308.6%	2.08	37	153	999
281 Industrial Inorganic Chemicals	2,980	3,075	3.2%	2.08	284	34	-223
361 Electric Distribution Equipment	1,385	1,659	19.8%	2.01	132	-29	171
Ten Lowest Manufacturing Sector Location Quotients (LQs) in 2000							
242 Sawmills and Planing Mills	*suppressed*	92	*N/A*	0.09	*N/A*	*N/A*	*N/A*
381 Search and Navigation Equipment	122	122	0.0%	0.09	12	-50	38
238 Miscellaneous Apparel and Accessories	13	33	153.8%	0.08	1	-1	20
335 Nonferrous Rolling and Drawing	311	127	-59.2%	0.08	30	56	-270
322 Glass & Glassware, Pressed or Blown	*suppressed*	40	*N/A*	0.06	*N/A*	*N/A*	*N/A*
232 Men's and Boys' Furnishings	120	117	-2.5%	0.03	11	-49	35
206 Sugar and Confectionery Products	18	16	-11.1%	0.02	2	-4	0
366 Communications Equipment	466	133	-71.5%	0.02	44	-12	-365
326 Pottery and Related Products	71	12	-83.1%	0.02	7	-8	-58
314 Footwear, Except Rubber	*suppressed*	14	*N/A*	0.02	*N/A*	*N/A*	*N/A*

Source: U.S. Bureau of Labor Statistics, *Covered Employment & Wages.*
Location quotients (LQ) and shift-share analysis calculated by TIP Development Strategies, Inc.